Math Coprocessor

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# Overview

The Math Coprocessor offers a variety of math operations with single cycle results (from the CPU’s point of view).

# Registers

The Math Coprocessor offers two input values and one result. They are named A, B, and R.

The registers are offered as two 8bit values in low,high order. Together, they behave as one 16bit register.

Each register can be treated as either signed or unsigned, as well as 8bit or 16bit, all through the use of a Format register.

There is also an opcode register, which controls which equation is computed. The registers are live, so the result is continually being calculated at all times. Once the Math Coprocessor is configured for a specific task, all you need to do is change the inputs (A and B registers) and observe the new output value (R registers).

The Status register offers additional information about the result, similar in concept to typical CPU status flags.

## The A Register (AH, AL, AX)

An input to math expressions.

## The B Register (BH, BL, BX)

An input to math expressions.

## The Result Register (RH, RL, RX)

The output from a math expression.

## The Opcode Register (OPCODE)

Choose which equation is being executed.

76543210  
xxxxxxxx

CODE Operation Expression Description  
0000 Add R = A + B   
0001 Multiply R = A \* B   
0010 Subtract R = A – B   
0011 Subtract R = B – A   
0100 Divide R = A / B Result is slightly delayed. Use NOPs before checking result.  
0101 Divide R = B / A Result is slightly delayed. Use NOPs before checking result.  
0110 Modulo R = A % B Result is slightly delayed. Use NOPs before checking result.  
0111 Modulo R = B % A Result is slightly delayed. Use NOPs before checking result.  
1000 Transfer R to A A = R   
1001 Transfer R to B B = R

## The Format Register (FORMAT)

Choose the format of each register involved. Formats can be mixed freely.

76543210  
xxRRBBAA

A: A Register Format (0=S16, 1=U16, 2=S8, 3=U8)  
B: B Register Format (0=S16, 1=U16, 2=S8, 3=U8)  
R: R Register Format (0=S16, 1=U16, 2=S8, 3=U8)

## The Status Register (STATUS)

Allows you to discover additional information about the result.

76543210  
xxxVUCNZ

V: Overflow flag (1=Overflow)  
U: Underflow flag (1=Underflow)  
C: Carry flag (1=Carry)  
Z: Zero flag (1=Zero)  
N: Negative flag (1=Negative)

# Address Map

The MathCoprocessor is located in the IO address space.

0x70 FORMAT  
0x71 OPCODE / STATUS  
0x72 AL  
0x73 AH  
0x74 BL  
0x75 BH  
0x76 RL  
0x77 RH